

## **Pathological study of a mass stranding of beaked whales associated with military naval exercises (Canary Islands, 2002)**

Antonio Fernández, Manuel Arbelo, Eva Sierra, Mariña Méndez, F. Rodríguez, and P. Herráez

University of Las Palmas de Gran Canaria, Veterinary School, Institute for Animal Health, Unit Histology and Pathology, Arucas, Gran Canaria, Canary Islands, Spain  
e-mail: [afernandez@dmor.ulpgc.es](mailto:afernandez@dmor.ulpgc.es)

### **Abstract**

A study of the lesions of beaked whales in a recent mass stranding in the Canary Islands following naval military exercises provides evidence of the possible relationship between anthropogenic, acoustic (sonar) activities and the stranding and death of marine mammals. Fourteen beaked whales were stranded in the Canary Islands close to the site of an international naval exercise (Neo-Tapon 2002) held on 24 September 2002. Strandings began about 4 hours after the onset of the use of mid-frequency sonar activity. Eight Cuvier's beaked whales (*Ziphius cavirostris*), one Blainville's beaked whale (*Mesoplodon densirostris*) and one Gervais' beaked whale (*M. europaeus*) were necropsied and studied histopathologically. No inflammatory or neoplastic processes were noted, and no pathogens were identified. Macroscopically, whales had severe, diffuse congestion and hemorrhage especially around the acoustic jaw fat, ears, brain, and kidneys. Gas bubble-associated lesions and fat embolism were observed in vessels and parenchyma of vital organs. This *in vivo* bubble formation associated with sonar exposure may have resulted in modified diving behavior that caused nitrogen super-saturation in excess of a threshold value normally tolerated by the tissues (as occurs in decompression sickness). Alternatively, a physical effect of sonar on *in vivo* bubble precursors (gas nuclei), the activation level of which may be lessened by nitrogen gas super-saturation of the tissues, may explain the phenomenon. Both mechanisms might also work together to augment and maintain bubble growth. Exclusively or in combination, these mechanisms might initiate the embolic process. Severely injured whales died, were killed by predators, or became stranded and died due to a more severe cardiovascular collapse during beaching. The present study demonstrates a new pathologic entity in cetaceans. This syndrome that is apparently fostered by exposure to mid-frequency sonar particularly affects deep, long duration, repetitive diving species like beaked whales.